

**NOAA / AOML / Hurricane Research Division
Hurricane Field Program
Advancing the Prediction of Hurricanes Experiment (APHEX)**

FLIGHT LOG -- 20210819H1

MISSION PLAN			
FLIGHT ID	20210819H1	STORM	AL07 / GRACE
MISSION ID	1607A	TAIL NUMBER	NOAA42
TASKING	EMC	PLANNED PATTERN	Butterfly
MISSION SUMMARY			
TAKEOFF [UTC]	1957	LANDING [UTC]	0230
TAKEOFF LOCATION	Lakeland	LANDING LOCATION	Lakeland
FLIGHT TIME	6.5	BLOCK TIME	6.9
TOTAL REAL-TIME RADAR ANALYSES (Transmitted)	3 (3)	TOTAL DROPSONDES (Good/Transmitted)	19 (19/19)
OCEAN EXPENDABLES (Type)	3 (ONR AXBTs; 2 good)	sUAS (Type)	None
APHEX EXPERIMENTS / MODULES	Early Stage Experiment: AIPEX		
HRD CREW MANIFEST			
LPS ONBOARD	Zawislak	LPS GROUND	Hazelton
TDR ONBOARD	Zawislak	TDR GROUND	Alvey, Gamache
ASPEN ONBOARD	Sellwood	ASPEN GROUND	None
NESDIS SCIENTISTS	None		
GUESTS (Affiliation)	None		
AOC CREW MANIFEST			
PILOTS	Mitchell, Rannenberg, Copare, Legidakes		
NAVIGATOR	Freeman, Hough		
FLIGHT ENGINEERS	Darby, Wysinger		
FLIGHT DIRECTOR	Carpenter		
DATA TECHNICIAN	Mascaro		
AVAPS	Underwood		

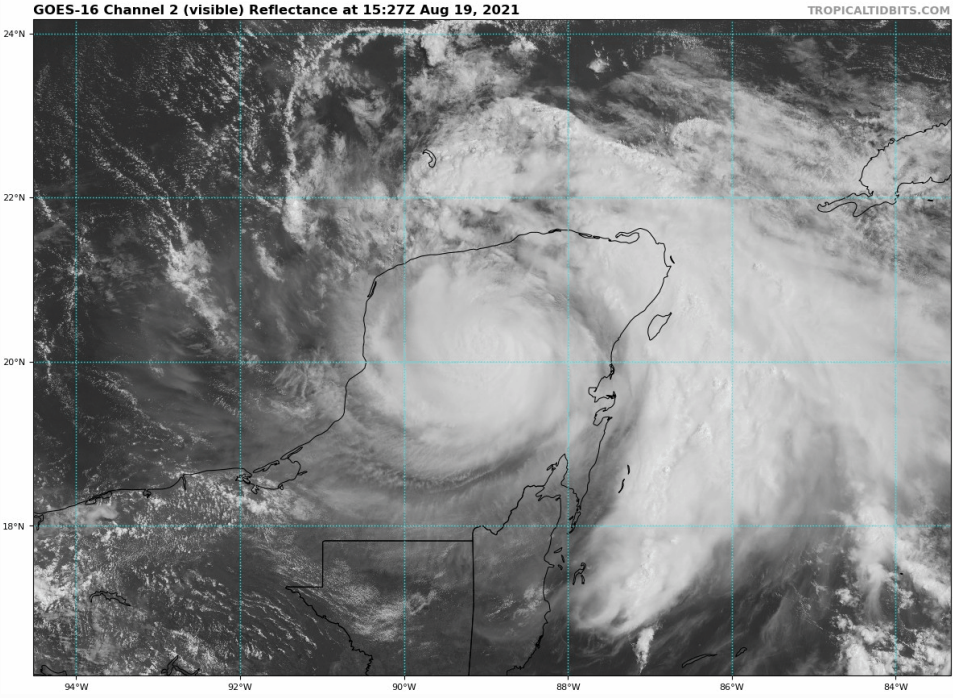
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PRE-FLIGHT	
Flight Plan	<p>Butterfly if no land clearance, but if everything goes well with Mexico overflight clearance, add a SE radial (150 degrees) that would make a full SE to NW pass on the 2nd of the storm. Fly at 10 kft.</p> <p>The map shows the Gulf of Mexico with latitude lines from 14N to 32N and longitude lines from 96W to 78W. Flight paths are marked with numbered points: 1, 4, 5, 8 (purple); 2, 3, 6, 7 (green); 10, 11 (blue). Sonde locations are marked with colored dots: purple (12 UTC Rawinsonde), cyan (00 UTC Rawinsonde), and red (00 and 12 UTC Rawinsonde).</p>
Expendable Distribution	<p>Endpoints, midpoints, centers; ONR TCRI adding potential sondes within 50 km of the center ("quarterpoint" drops between midpoint and center) ONR AXBTs (combo drops) at endpoints 1, 4, 5</p>
Preflight Weather Briefing	<p>Grace was downgraded by NHC in the 1500 UTC advisory to a 55 kt tropical storm, although the exact intensity is unknown -- the estimate was predominantly informed by decay SHIPS. The mission today will be the first look as the storm emerges back into the Gulf of Mexico in the Bay of Campeche, and a look at how the structure and intensity has changed after its trip over the Yucatan Peninsula. Just judging by satellite imagery, the inner core has not shown particularly impressive convection, but overall the inner core seems to have remained fairly organized, which is possible given the lack of terrain over the Yucatan. There is a hint of some impact of northerly moderate deep-layer shear, though, as the north side</p>

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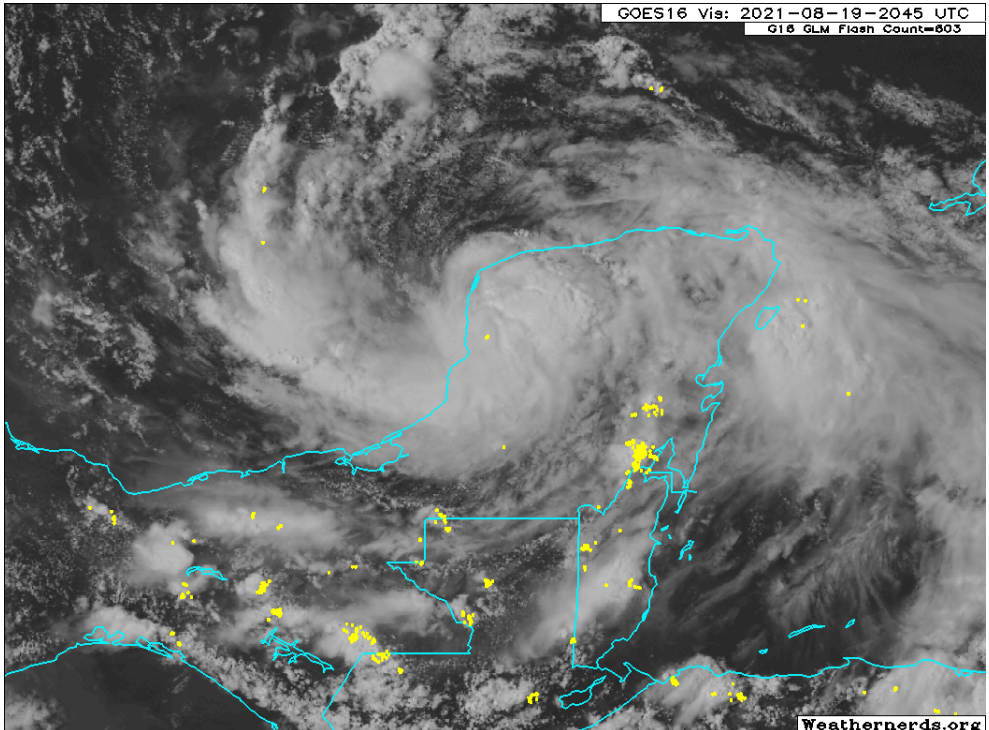
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	<p>has less precipitation coverage than the southern (downshear) side. Although, there is still some evidence of dry intrusion from the eastern to north sides of the storm, separating the inner core precipitation shield from the outer rainband activities, which has remained over water and is convective active.</p> <div style="text-align: center;">  </div>
Instrument Notes	All instruments working nominally; cloud microphysics were not operable in the previous flight, but appear to be working for this flight.

IN-FLIGHT	
Time [UTC]	Event
1957	Takeoff from Lakeland
2107	Appears to be moving off the coast

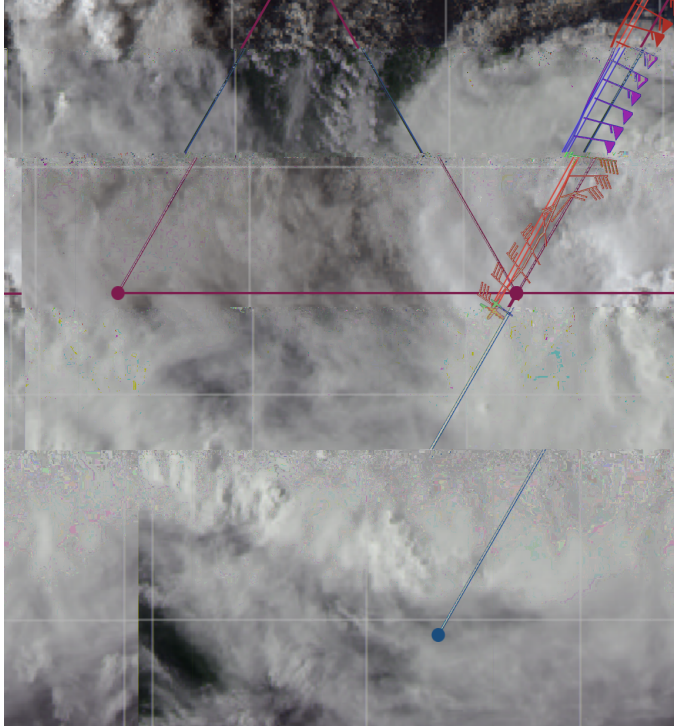
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	 <p>GOES16 Vis: 2021-08-19-2045 UTC G16 GLM Flash Count=603</p> <p style="text-align: right;">Weathernerds.org</p>
2145	Sonde #1 (Endpoint NE), BT #1
2147	Plan to do a microphysics spiral at the end of the first pass
2157	Sonde #2 (Midpoint NE)
2201	Apparent comms outage
2201	Sonde #3 (Quarterpoint NE)
2206	Sonde #4 (Center)
2210	Discussing plan for MP spirals and downwind legs
2210	Sonde #5 quarterpoint SW

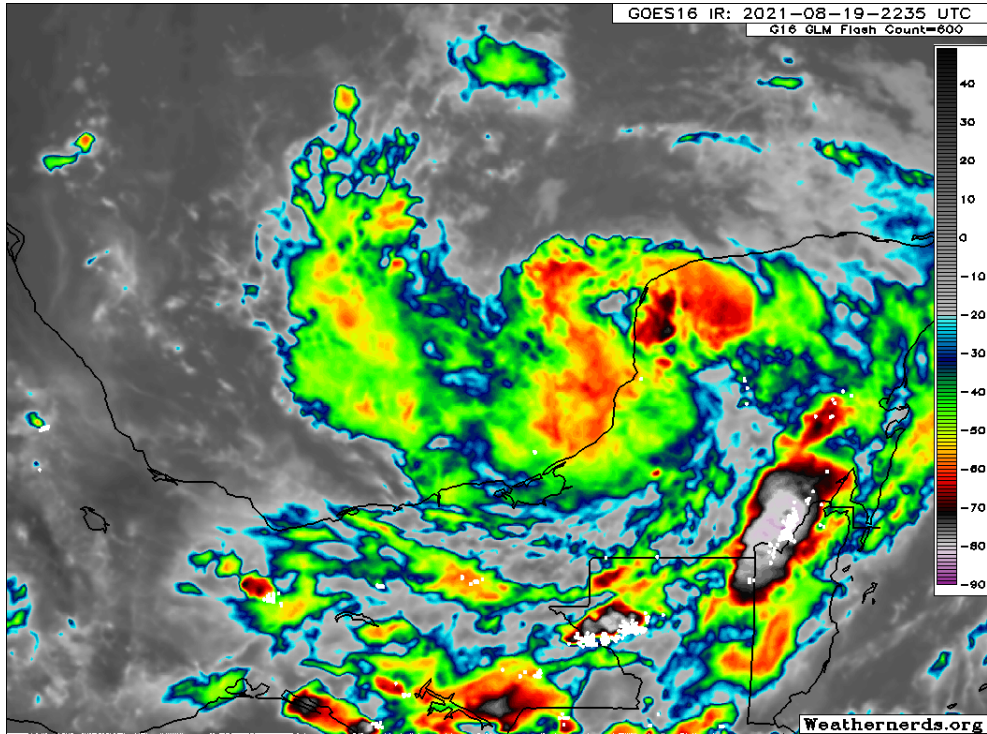
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2216	 <p>Trying to find an area out of convection for the stratiform microphysics spiral, but unfortunately the precipitation on the SW side on the outbound leg is mostly convective with no widespread regions of stratiform precipitation.</p>
2219	Sonde #6 midpoint SW
2226	Ending SW leg a little early due to convection and ships
2226	Endpoint SW Sonde #7
2232	No microphysics spiral due to convection
2242	Inbound from SE

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2248	
2249	Sonde #8 Midpoint/quarterpoint SE
2255	Center sonde #9
2304	Quarterpoint sonde #10 NW
2308	Sonde #11 Midpoint NW
2319	Combo Drop (Sonde #12, BT #2) Endpoint NW, 30C SST
2329	Strong but still asymmetric wind field on the north side

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	<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>210819H1 (GRACE) 214500 to 222400 UTC Reflectivity (dBZ) at 2.0 km</p> </div> <div style="width: 45%;"> <p>210819H1 (GRACE) 214500 to 222400 UTC WS (kt) at 2.0 km: Streamlines at 2.0, 5.0 km</p> </div> </div>
2342	Sonde #13 Inbound from W
2356	Midpoint sonde #14 W
0000	<p>Core convection mostly shallow as the sun sets</p> <p>GOES-16 Channel 2 (visible) Reflectance at 23:42:01Z Aug 19, 2021 TROPICALTIDBITS.COM</p>

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0003	Sonde #15 Quarter point west (ONR)
0009	Sonde #16 Center
0015	Quarterpoint Sonde #17
0023	Midpoint Sonde #18
0037	Endpoint Sonde #19
0111	<p>Final radar analysis</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>210819H1 (GRACE) 214500 to 242000 UTC Reflectivity (dBZ) at 2.0 km</p> </div> <div style="text-align: center;"> <p>210819H1 (GRACE) 214500 to 242000 UTC WS (kt) at 2.0 km; Streamlines at 2.0, 5.0 km</p> <p>2-km MaxV_r (RMW): 24 m/s (48 km) SHIPS Shear (SHDC): 5.7 kt @ 169 deg</p> </div> </div> <p>Some tilt to the South suggested</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>210819H1 (GRACE) 214500 to 242000 UTC Vorticity (10^{-4} s^{-1}) at 2.0 km</p> </div> <div style="text-align: center;"> <p>210819H1 (GRACE) 214500 to 242000 UTC Vorticity (10^{-4} s^{-1}) at 5.0 km</p> </div> </div>

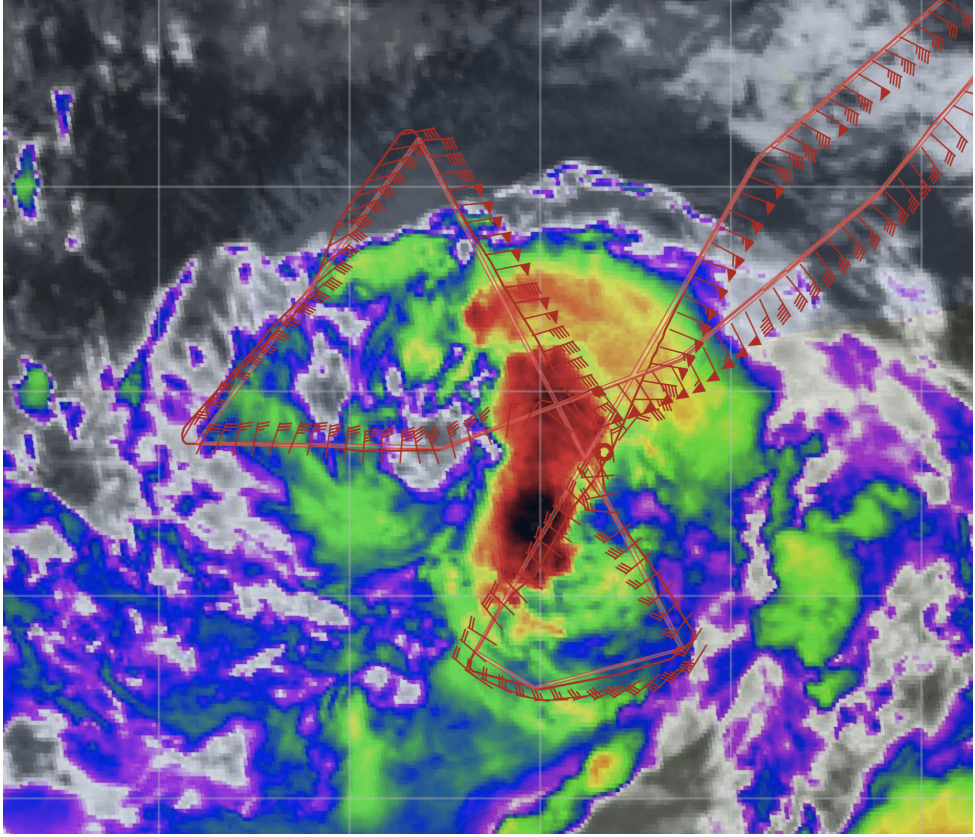
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POST-FLIGHT	
Mission Summary	<p>We flew a butterfly pattern into Tropical Storm Grace as it moved off of the Yucatan Peninsula, with a couple of legs slightly modified due to land. The data revealed that the circulation was still relatively intact after interacting with the Yucatan, although it was still quite asymmetric as noted in previous flights. While NHC had the intensity at 45 kt and MSLP of 999 mb, the observations from the flight suggested that the storm emerged off the Yucatan with a slightly lower MSLP (994 mb) and stronger winds (55 kt). Hurricane-force winds were even observed at 0.5 km in the TDR analyses, though no evidence of hurricane-force winds were otherwise observed in dropsondes or the SFMR. The highest SFMR winds were about 60 kt, though those may have been impacted by the close proximity to the shore and shallower water where SFMR is less reliable.</p> <p>Convection was a little shallow, but some stronger echoes developed on the E and NE side towards the end of the flight. Most of the eyewall on the north to western sides consisted of shallow clouds and precipitation (below 6 km). For most of the flight those sides were fairly open and clear out from the eyewall to beyond 100 miles, perhaps due to the impact of shear. So there was a distinct cloud and precipitation asymmetry within the inner and outer regions of the storm. We expect it to become more symmetric over the next 24 hours as the storm potential intensifies. Given the forecast of the strengthening, perhaps even rapidly, this flight could serve as a great research contribution as an “onset” flight to intensification.</p> <p>The radar data suggested some southward tilt with height, especially above 6-7 km, but it looks like the center is fairly broad at upper levels.</p> <p>Three analyses were transmitted to EMC successfully. No major data issues. 19 dropsondes were released and transmitted, with 14 charged to NWS and 5 charged to ONR.</p>
Actual Standard Pattern Flown	Butterfly with some slight modifications due to land and outerband convection on the south side (where the first outbound to the SE, and inbound from the SW over land) had to be shortened. The entire pattern was flown at 10 kft, since the Teal aircraft remained at 5 kft.
APHEX Experiments / Modules Flown	This pattern will be of interest to the <i>Early Stage Experiment: AIPEX</i> as the storm appears primed to intensify. No other modules, including the planned stratiform microphysics spiral due to a lack of target. Flown in collaboration with ONR TCRI.
Plain Language	<ul style="list-style-type: none"> • We got 3 passes through Tropical Storm Grace as it came off of

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Summary	<p>the Yucatan Peninsula and began to re-strengthen.</p> <ul style="list-style-type: none"> • The winds on the north side of the circulation continued to be stronger than those on the south. • Data was sent to EMC to help the model forecasts
Instrument Notes	<p>Some artifacts in the radar data along the flight track where the winds were weak and the land was in view of the TDR; therefore, some reprocessing of the level-2 will be required before its release.</p> <p>19 dropsondes released (14 NWS, 5 ONR) 3 ONR AXBTs released (2 good)</p>
Final Mission Track	

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